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AGRICULTURAL RESEARCH
FOR DEVELOPMENT

The metrological approach

A major key factor for the continuous improvement of the wood preservation laboratory

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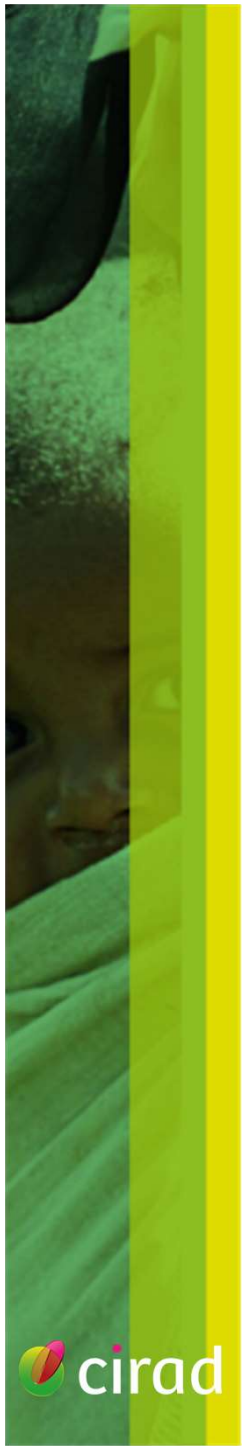
1 Presentation of the wood preservation laboratory

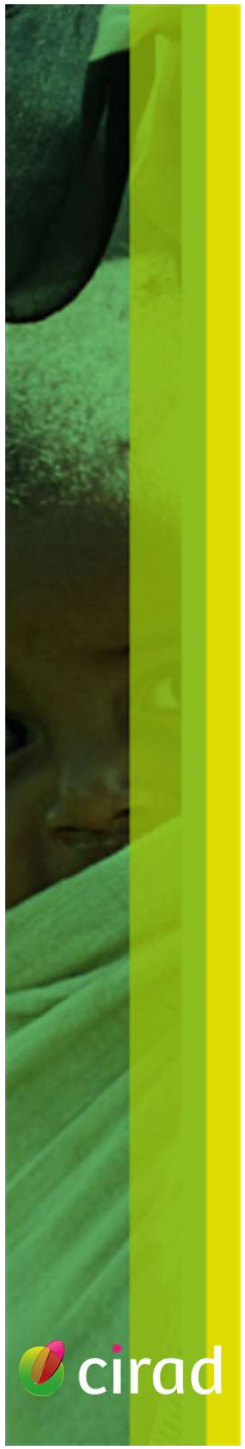


Research fields

- Rational use of lignocellulosic materials (wood)
- Service-life of ligno-cellulosic/wooden commodities
- Protection products & processes with low environmental impact

Main tasks

- Evaluation & comprehension of natural durability
- Development of products and wood processing with low environmental impact
- Evaluation of wood preservative chemicals



Activities

- Research
- Expertises
- Tests

Activities

- Research
- Expertises
- Tests → on durability of wood and wood-based products
  → on the protective efficacy of wood preservatives

Accreditation COFRAC for 8 tests

Accreditation N° 1-1686

- **Termite tests** according to EN 117 and EN 118
- **Fungal tests** according to EN 113 and XP ENV 12038
  Associated accelerated ageing procedures according to EN 73 and EN 84
- **Termite control products tests** according to XP X 41-550
  Associated ageing procedure according to XP X 41-542

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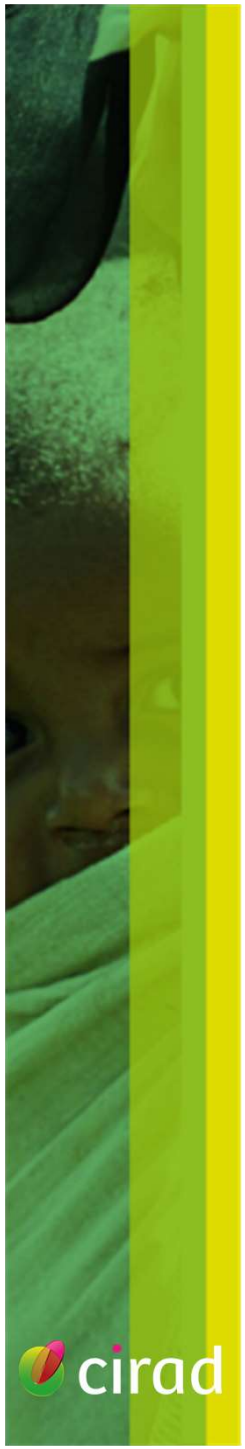


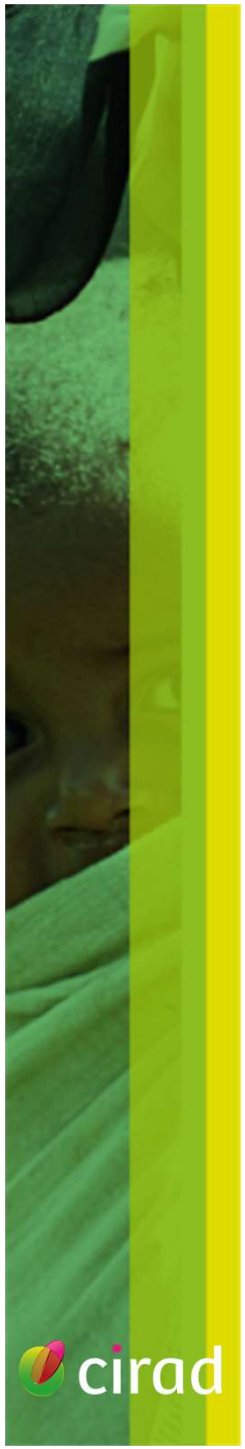
Determination of the resistance against wood-destroying agents !

Diversity of organisms

?

Evaluation of the impact
Biological degradation

Material heterogeneity



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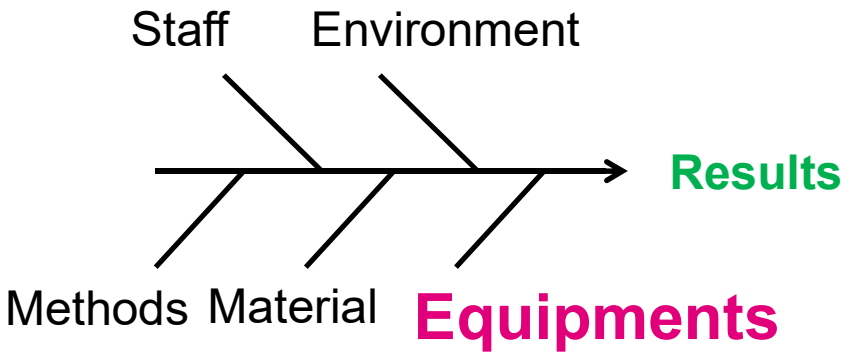

Equipment pool

- **60 measurement devices** including 14 measurement standards
- Management with SPLIT4® software
- Physical quantities: length, angle, weight, temperature, hygrometry, pressure, volume, air flow

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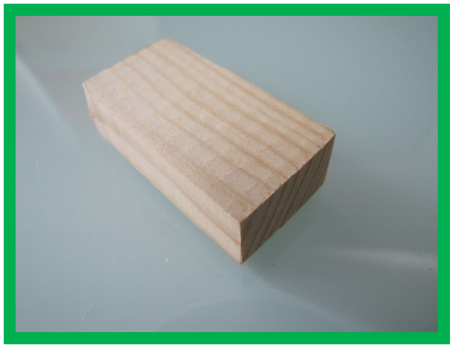
Crucial steps of EN 117 test and metrological associated issues

EN 117 standard

Wood preservatives – Determination of toxic values against *Reticulitermes* species (European termite)

Determination of the concentration at which the product completely prevents attack by termites of impregnated wood of a susceptible timber species

→ **Scots Pine sapwood treated with a wood protection product using different concentrations**



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Method

- **Treatment** through a vacuum-pressure device (core impregnation)
- Measurement of the **quantity of product introduced** into the wood = product retention
- Drying (and eventually accelerated ageing)
- **Exposition of treated wood blocks** in culture flask to **250 termite workers** (8 weeks)
- Wood samples removed from the flasks
- Determination of the **number of survivors**
- **Visual rating of wood samples** (evaluation of the degree of attack)

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Crucial steps

- Wood selection
- Counting the number of termites
- Visual quotation of the wood samples

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Crucial steps

- **Wood selection**
- Counting the number of termites
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Requirements

→ Reduce as much as possible the variability of the matrix

- **Timber to use**

Exclusively sapwood containing little resin

- **Proportion of latewood** < 30%
- **Ring orientation**

Between 2.5 and 8 annual rings / cm

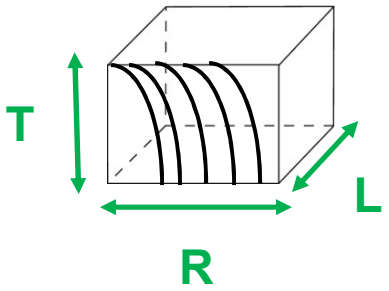
Contact angle > 10° to the broad faces of test specimens

- **Dimension of the blocks**

Length: (50.0 ± 0.5) mm in longitudinal plan **L**

Width: (25.0 ± 0.5) mm in radial plan **R**

Thickness: (15.0 ± 0.5) mm tangential plan **T**



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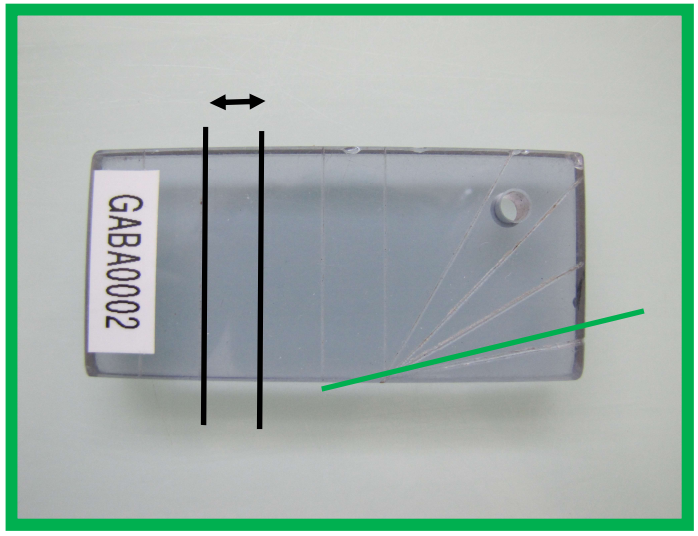
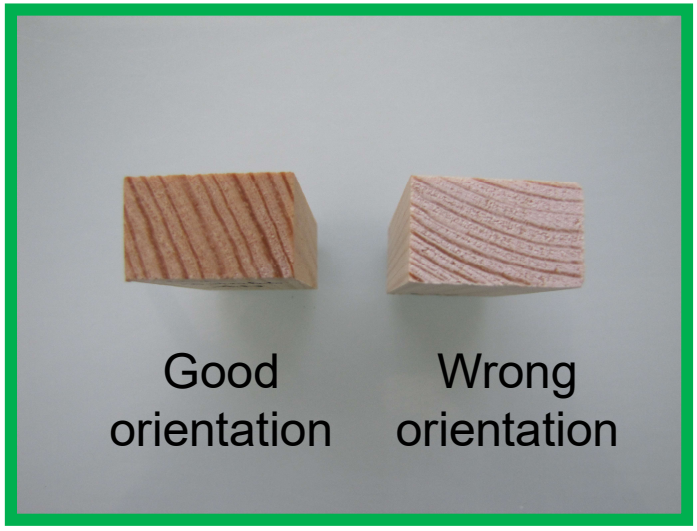
Metrological associated issue

- **Test gauge**

Verification of orientation and proportion of annual rings





Help for operators

When the wood is cut: from tree log to plank and then to samples

When the blocks are selected for the test

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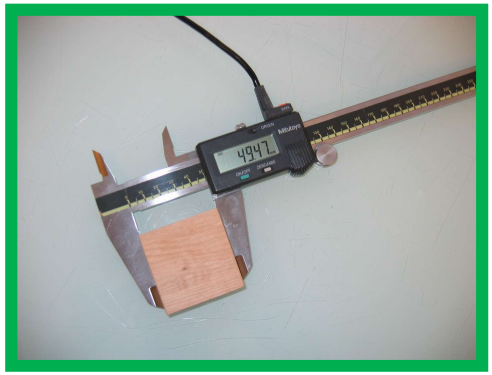
After this first selection…

- **Wood blocks must be measured**



- **Wood blocks must be weight**

⟶ Determination of the density

Initial weight + **density** ⟶ Product **retention** calculation

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Crucial steps

- Wood selection
- **Counting the number of termites**
- Visual quotation of the wood samples

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Requirements

- Exposition to **250 termite workers** in a device
- For a complete evaluation: **40 devices ⟶ 10,000 termites!!**

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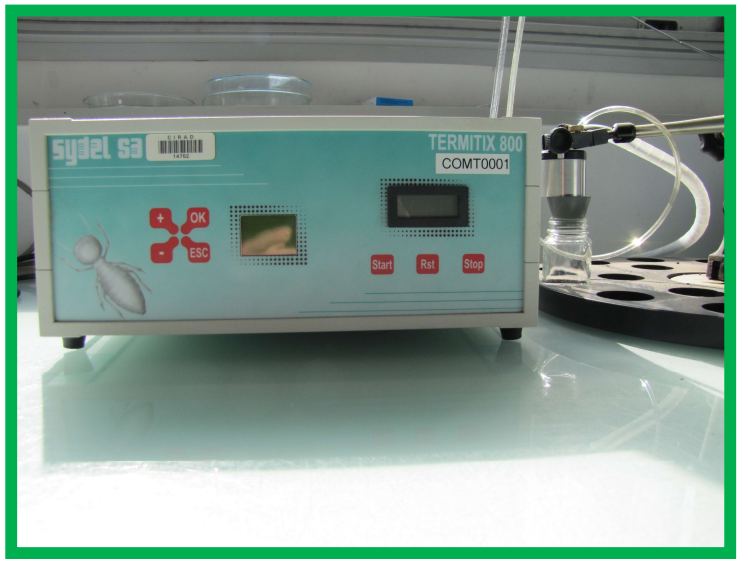
Metrological associated issue

- **Termite-meter**



Aspiration speed carefully chosen

→ Not to affect the survival rate or vitality of termites

Detection of the photo-sensible cell

→ Exact number given

→ Only termites are detected

Help for operators

Average time saving of **50%** for a test set up!!

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Crucial steps

- Wood selection
- Counting the number of termites
- **Visual quotation of the wood samples**

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Requirements

- After **8 weeks of biological exposure…**

(27 ± 1)° C > 75%HR

- … Wood samples are removed

  and **termites remained alive** are counting (by hand)

- **To be declared valid**, the **virulence controls** must present

  → a **termite survival of 50%**

  → a **strong level of attack** (level 4)

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Expression of examination (1)

- **Classification** of attack by
  - → its **locality**
  - → its **extent**
  - → its **depth**
- **Expression** in accordance with the following schedule
  - → Level 0: No attack
  - → Level 1: **Attempted attack**
  - → Level 2: **Slight attack**
  - → Level 3: Average attack
  - → Level 4: Strong attack

  Each level of attack can be a **combinaison of 2 criteria**

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Expression of examination (2)

- Example ⟶ **Level 1** is reached for

  (i) Superficial erosion of insufficient depth to be measured on an unlimited area of the test specimen

or **(ii)** Attack to a depth of 0.5 mm provided that this is restricted to an area or areas not more than 30 mm^2 in total

or **(iii)** A combination of (i) and (ii)

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Metrological associated issue

1. **Visual examination** of each test specimen **individually** performed by **3 operators**

2. **Results commonly** reviewed by **all operators**
3. When **divergences** occur, **discussion** leads to a given rating

→ « **Laboratory result** »

Inter-operator test according to ISO 5725-2

→ **Operators qualification** (not uncertainty estimation…)

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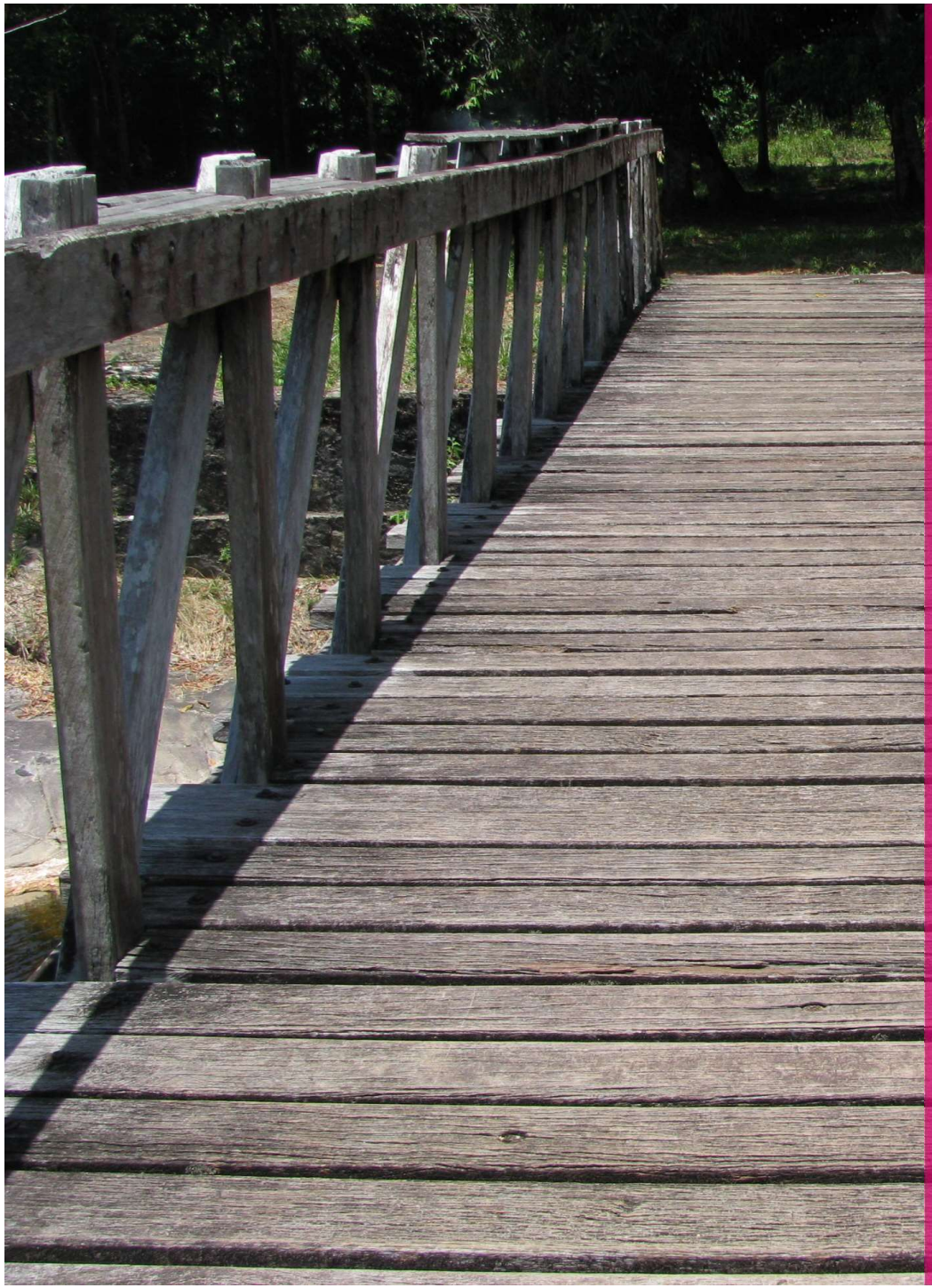

3

Discussion & Conclusion

Zimbabwe
Reunion
Madagascar
Burkina Faso
Mexico
Laos
Brazil

EN 117 standard aims to know what is the **preventive protection level** against termites of a pine sapwood wood block containing a certain amount of product (**retention**) at a **given concentration**

1. For a **fixed concentration**, **retention** of wood preservative product in sample depends on **initial weight** and **volume**
   - → **Wood selection** crucial step
   - → **Test gauge** essential tool

Intermediary retention result estimated according to **ENV 13005**

2. **Final result** on level attack relies on **technical competence** of laboratory operators

Inter-operator comparison accoding to **ISO 5725-2**

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Metrological point of view

- Methods such as **3D-image analysis** could substitute visual rating ?

Scientific point of view

- New way of measuring termite degradation should be developed according to **evolution of preservative products formulations** (toxicity + repellency)

→ Inter-laboratory cross-checking tests to develop new method based on **choice test**

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Conclusion

- Accreditation is a garantee of **laboratory's expertise** for research partners or to **respond to tenders** for European projects

- **Development of measuring instruments adapted** to constrainsts of our testing has strengthened **competence of operators** and appears as an **important factor in improving laboratory practices**

- Metrological approach is a **long-term process**, extension to

  → Other **standardized tests**

  → **Development of new methods**

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Thank you !

Merci !